FAA Evaluation of Proposed Outdoor Laser Operations

Federal Aviation Administration

Presented to: 2008 NASA Health Physics Conference

By: Steve Rohring, FAA Focal Point for Outdoor Laser Operations

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Introduction

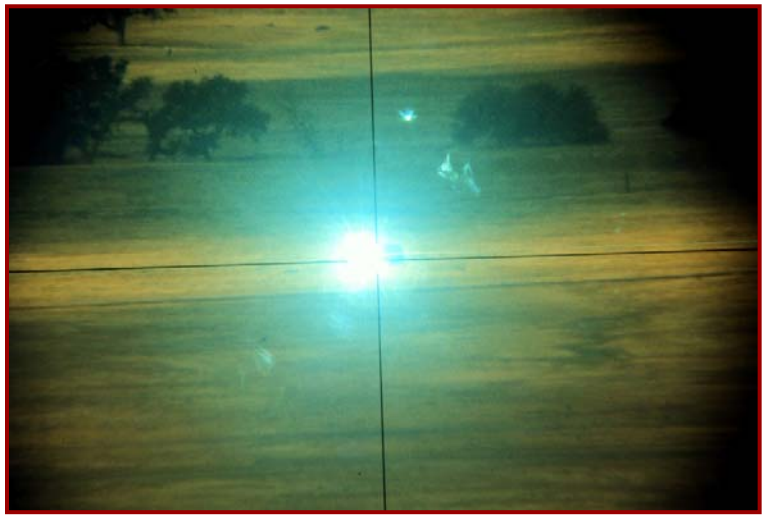
- Why does the FAA care about outdoor laser operations?
- How does the FAA evaluate laser proposals?
- How can the FAA's laser automation aid NASA?
- What tools/databases are available in the FAA's laser evaluation system.

Potential Adverse Visual Effects

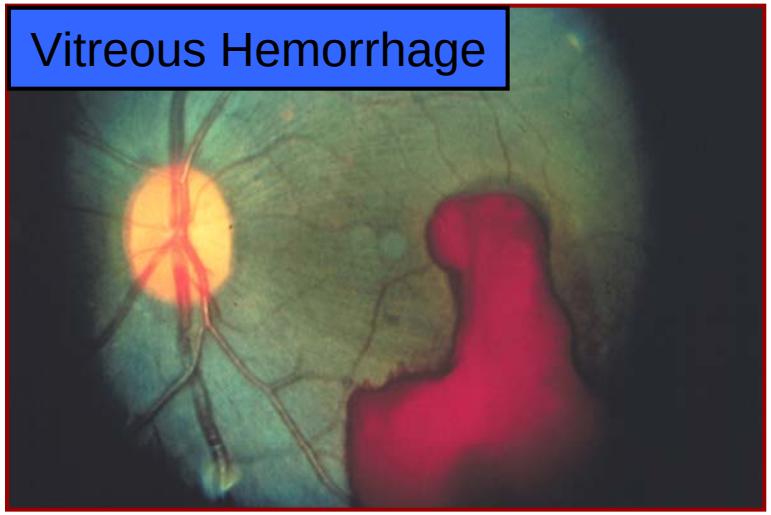
- Distraction
- Startle
- Glare
- Flashblindness
- Afterimage

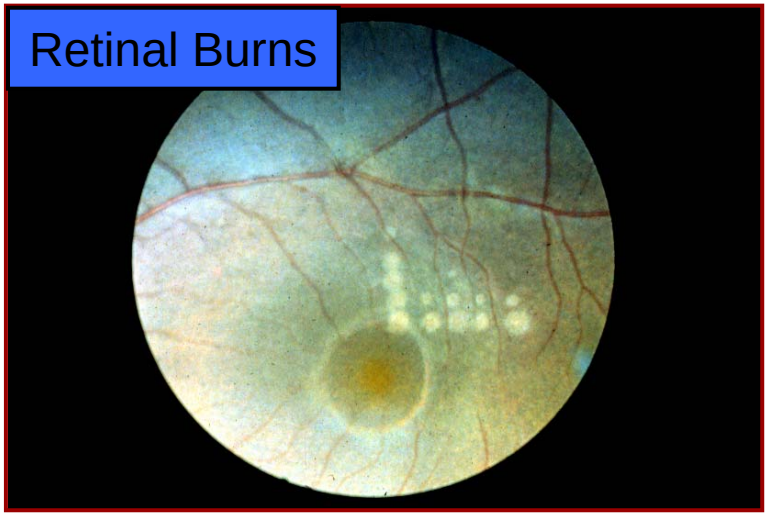
Greatest potential to cause an aircraft accident when an aircraft is flying at low altitudes and when pilots are performing critical tasks during landing and take-off.

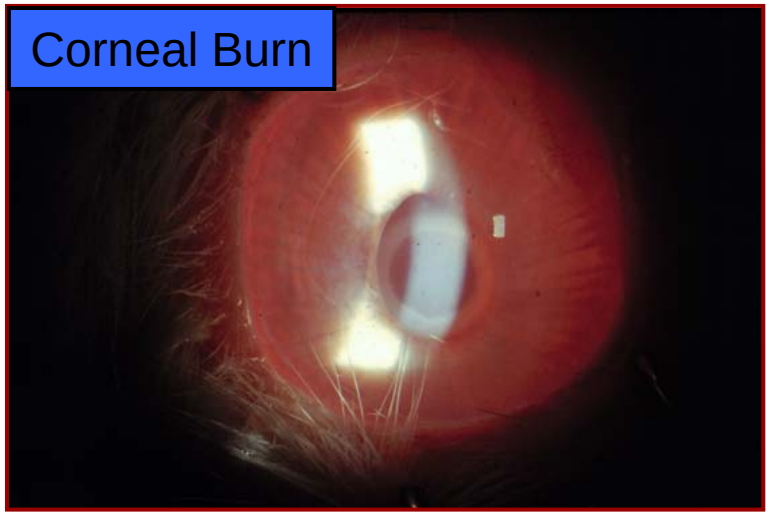
Example of Laser Glare



Potential Eye Damage







How to Notify the FAA

- **FAA Form 7140-1, Notice of Proposed Outdoor Laser Operation(s).**
  http://forms.faa.gov/forms/faa7140-1.pdf

- **This is a 2-page form. The first page asks for general information. The second page is a Laser Configuration Worksheet that should be completed for each individual laser.**

- **FAA AC 70-1, Outdoor Laser Operations:**
  http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/a79d573e9ff2aaaa86256f9d00583fe0/$FILE/AC70-1.pdf

Can NASA Notify the FAA Electronically?

- **Not Yet, however, Pat Hancock, currently evaluating the system for use by NASA.**

- **The FAA prefers one NASA focal point for entering proposals into the System.**

- **Patrick's contact information is:**
  - **General Engineer**
  - **Occupational Health Team Lead**
  - **GSFC, Code 250**
  - **301 286-5605**
  - **301 286-1745 (fax)**

When to Notify the FAA, cont.

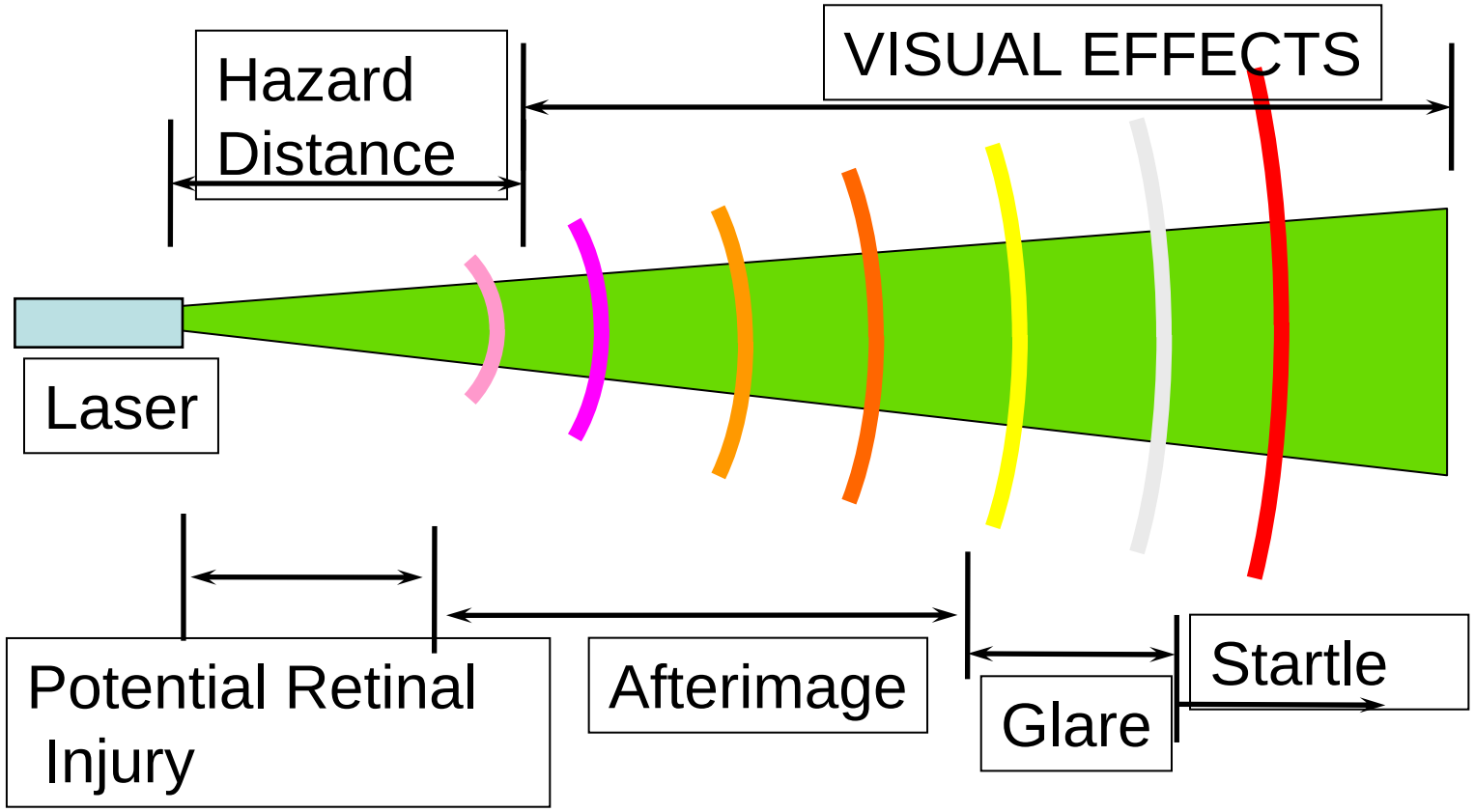
- **Scientific/research lasers - at least 6 months in advance (include specific details on control measures that you intend to use ensure aviation safety)**
- **Evaluation is more complex than laser light shows**
- **May require a complex Safety Risk Management Assessment**
- **Typically takes 6 months or longer to complete.**

FAA Process

The FAA's Air Traffic Organization (ATO)

- Receives FAA Form 7140-1, Notice of Proposed Outdoor Laser Operation(s)
- Evaluates proposals in accordance FAA Order 7400.2, Procedures for Handling Airspace Matters
- The FAA's Regional Flight Standards Divisions conduct a Safety Analysis, and
- ATO Issues letters of objection or no objection.

Laser Hazards vs. Distance



From “Commercial Laser Pointers and Night Flying – Don’t Be Startled,” presentation, by D.H. Sliney, US Army Center for Health Promotion and Preventative Medicine, Laser/Optical Radiation Hazards Program (DOHS/25), Laser Eye Protection, p. 28.

Measurements, MPE & NOHD

Maximum Permissible Exposure (MPE)
The level of laser radiation to which a person may be exposed **without hazardous effect or adverse biological change in the eye or skin**. This value is used in the calculation of Nominal Ocular Hazard Distance (NOHD).

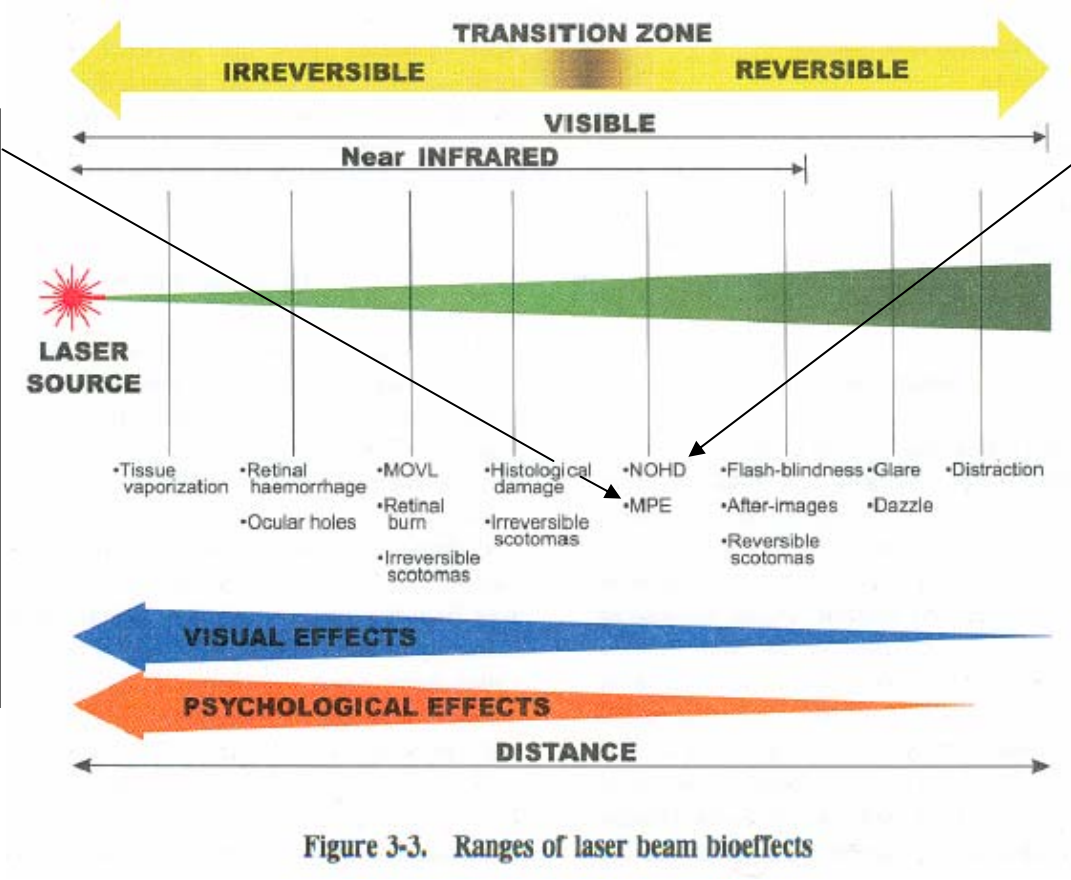


Figure 3-3. Ranges of laser beam bioeffects

Nominal Ocular Hazard Distance (NOHD)
The maximum distance from the laser system beyond which the laser beam irradiance **does not exceed the MPE for that laser**.

The beam is an eye hazard from the laser source to this distance.

Flight Zones/Distances

Flight Zones

- Laser Free Zone (LFZ)
- Critical Flight Zone (CFZ)
- Sensitive Flight Zone (SFZ)
- Normal Flight Zone (NFZ)

Calculated Laser Beam Distances

- Laser Free Exposure Distance (LFED)
- Critical Zone Exposure Distance (CZED)
- Sensitive Zone Exposure Distance (SZED)
- Nominal Ocular Hazard Distance (NOHD)

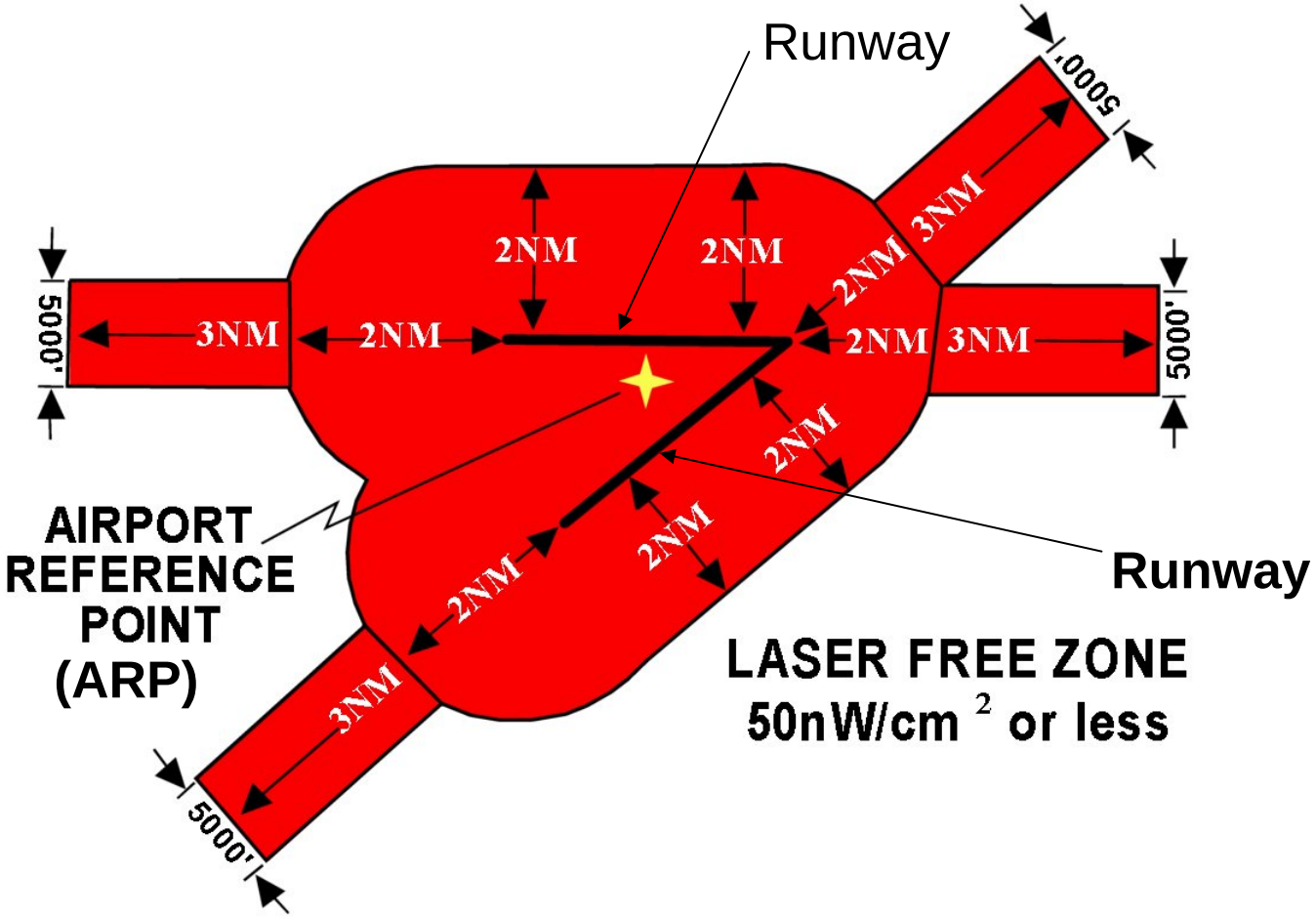
Calculated Laser Beam Distances

There are four laser beam distances that are important in evaluating the safety of ground-based outdoor laser operations.

1. **Nominal Ocular Hazard Distance (NOHD) - The beam is an eye hazard (is above the MPE), from the laser source to this distance.**
2. **Sensitive Zone Exposure Distance (SZED) - The beam is bright enough to cause temporary vision impairment, from the source to this distance. Beyond this distance, the beam is 100μW/cm^2 or less.**
3. **Critical Zone Exposure Distance (CZED) - The beam is bright enough to cause a distraction interfering with critical task performance, from the source to this distance. Beyond this distance, the beam is 5 μW/cm^2 or less.**
4. **"Laser-Free" Exposure Distance (LFED) - The beam is dim enough that it is not expected to cause a distraction. Beyond this distance, the beam is 50nW/cm^2.**

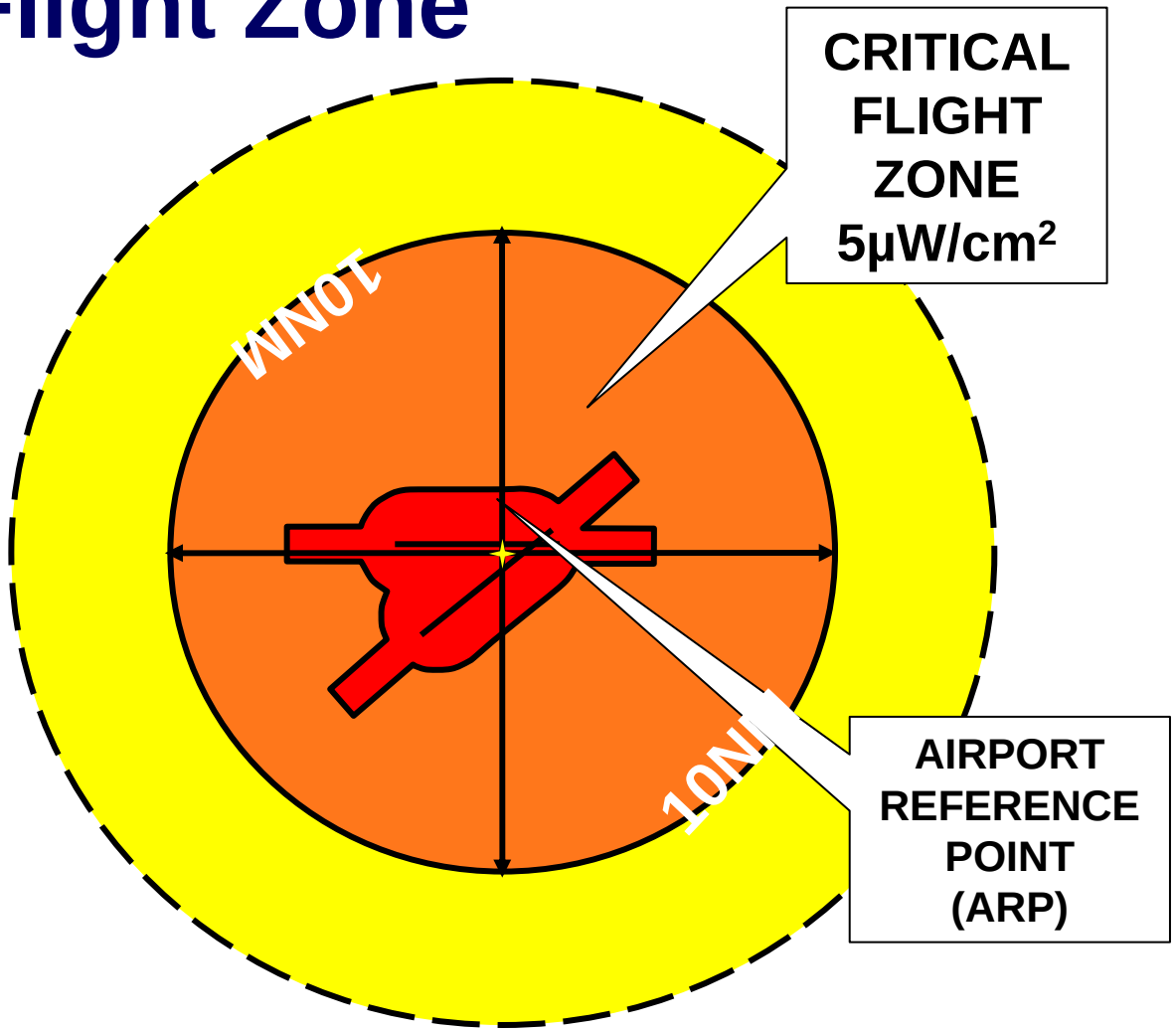
The laser beam distances are calculated by the laser proponent and reported on the Configuration Worksheet, FAA Form 7140-1.

Airspace Flight Zones, cont.
Laser Free Zone

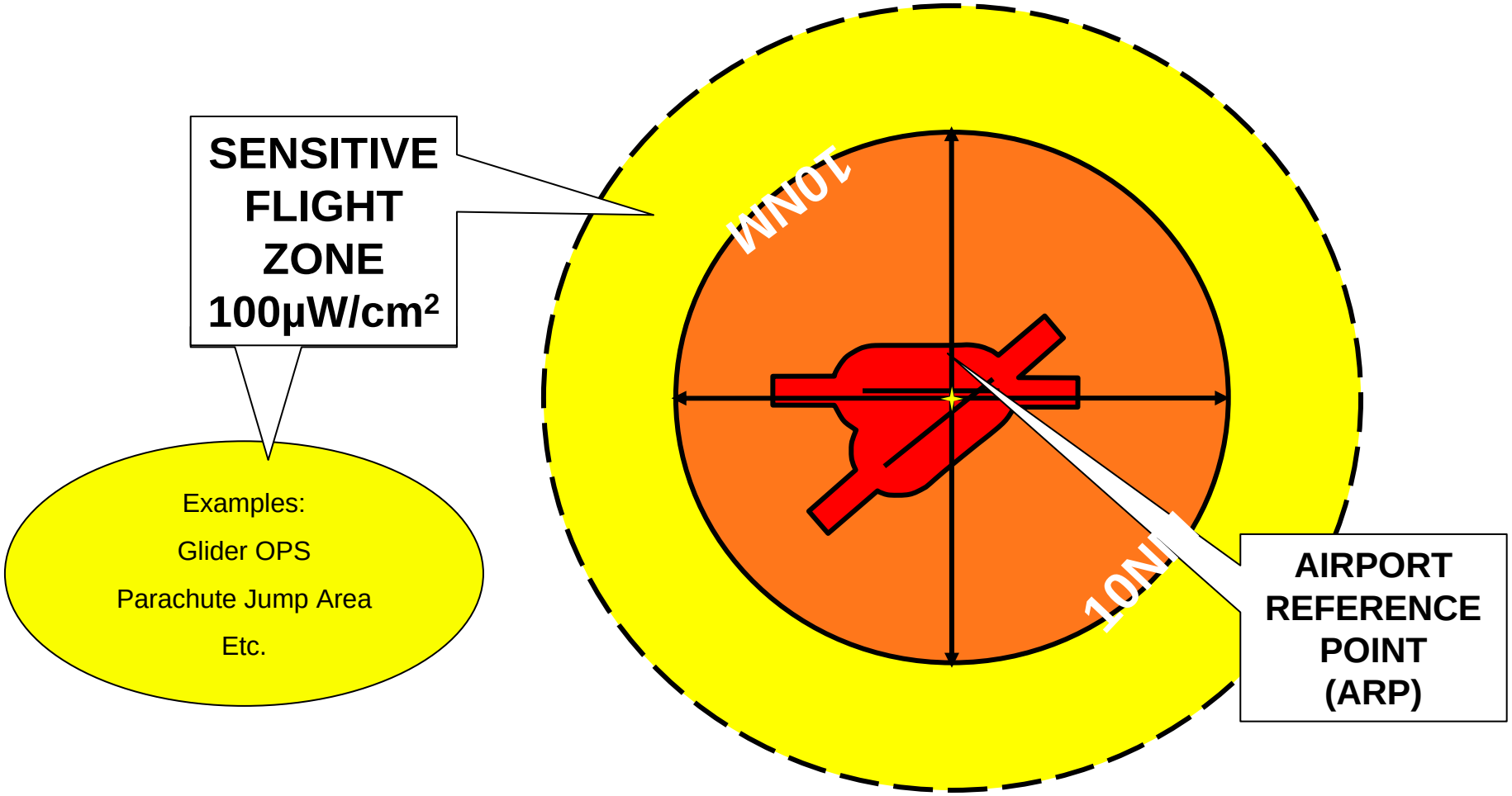


Airspace Flight Zones, cont.

Critical Flight Zone

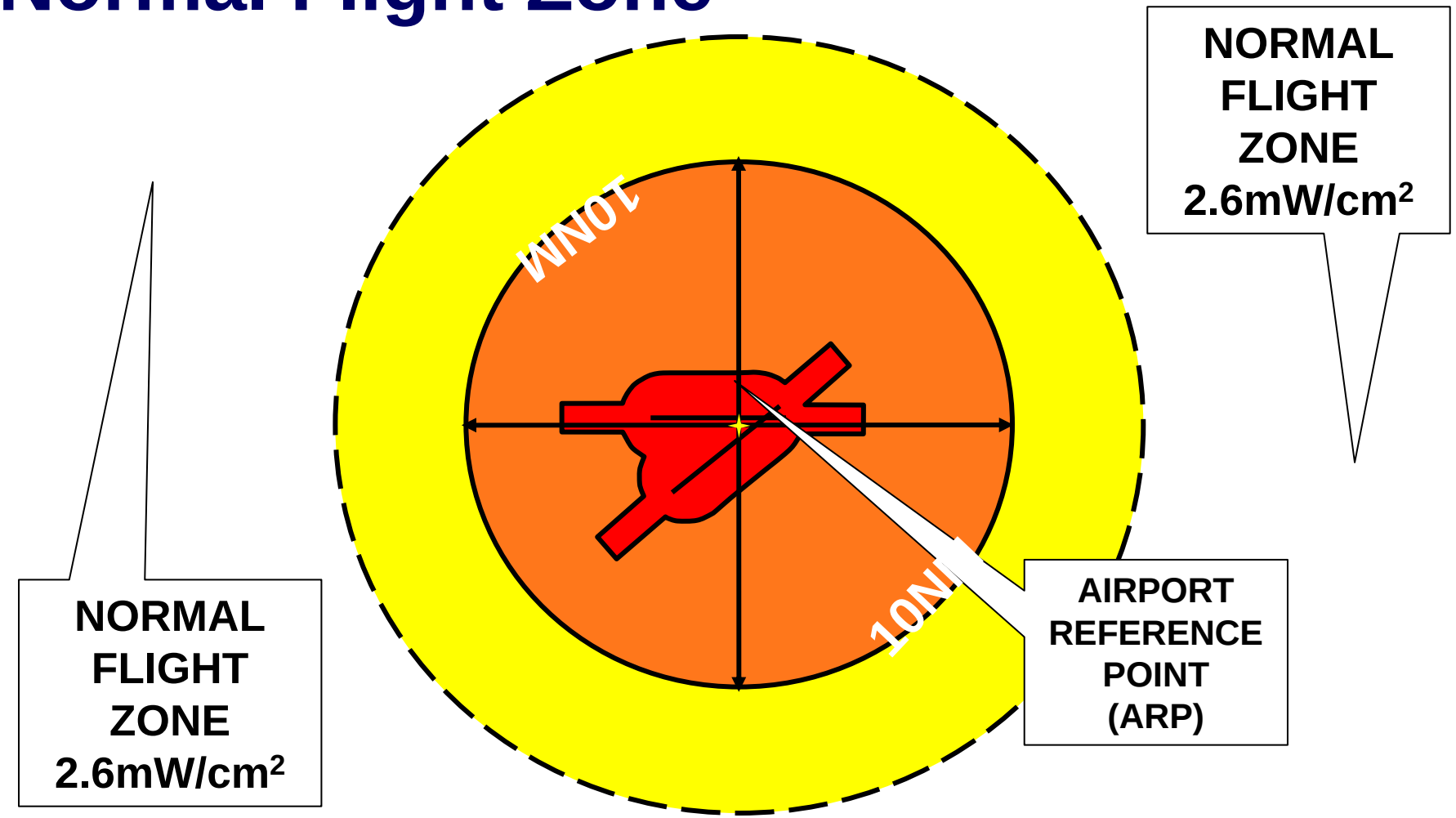


Airspace Flight Zones, cont.
Sensitive Flight Zone

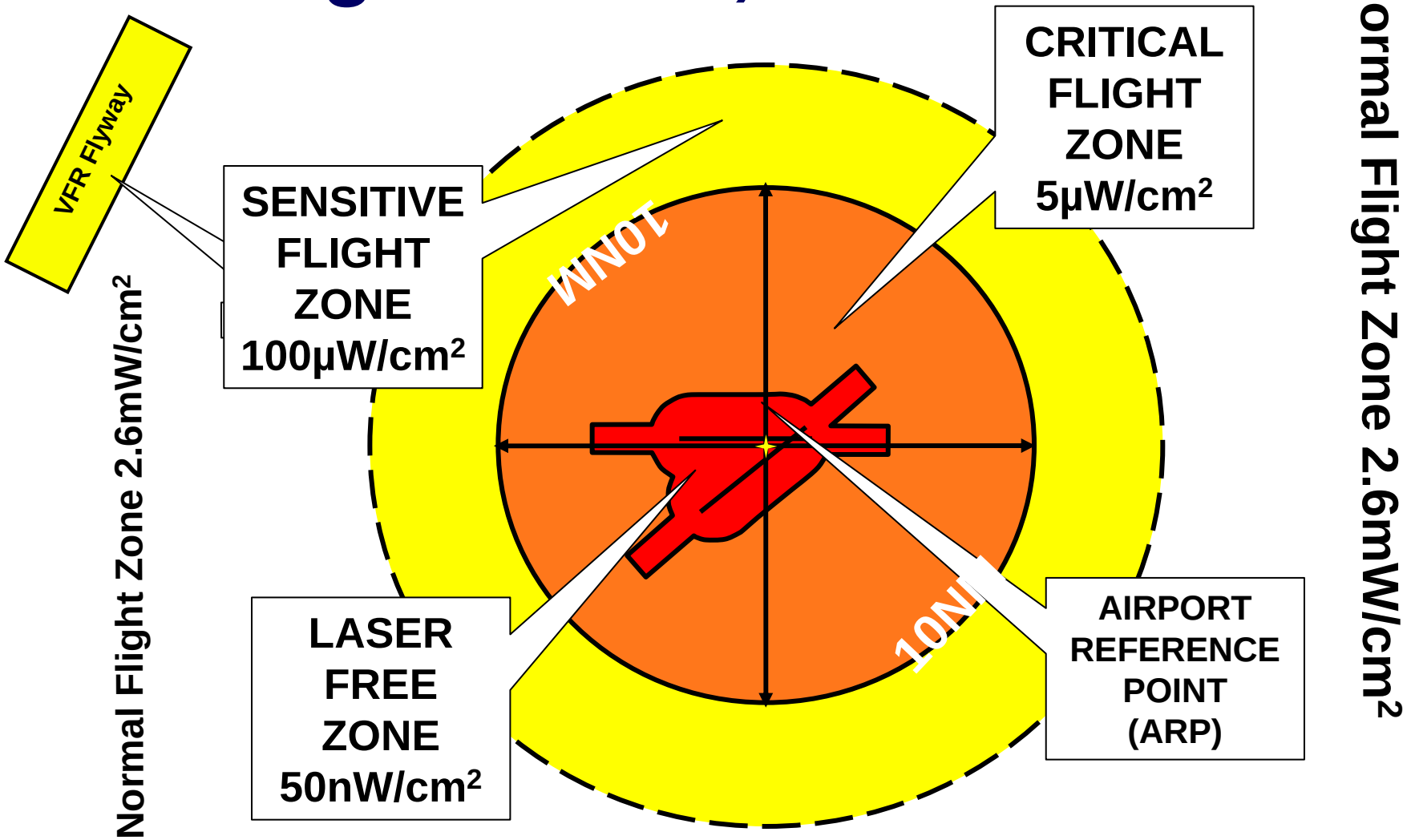


Airspace Flight Zones, cont.

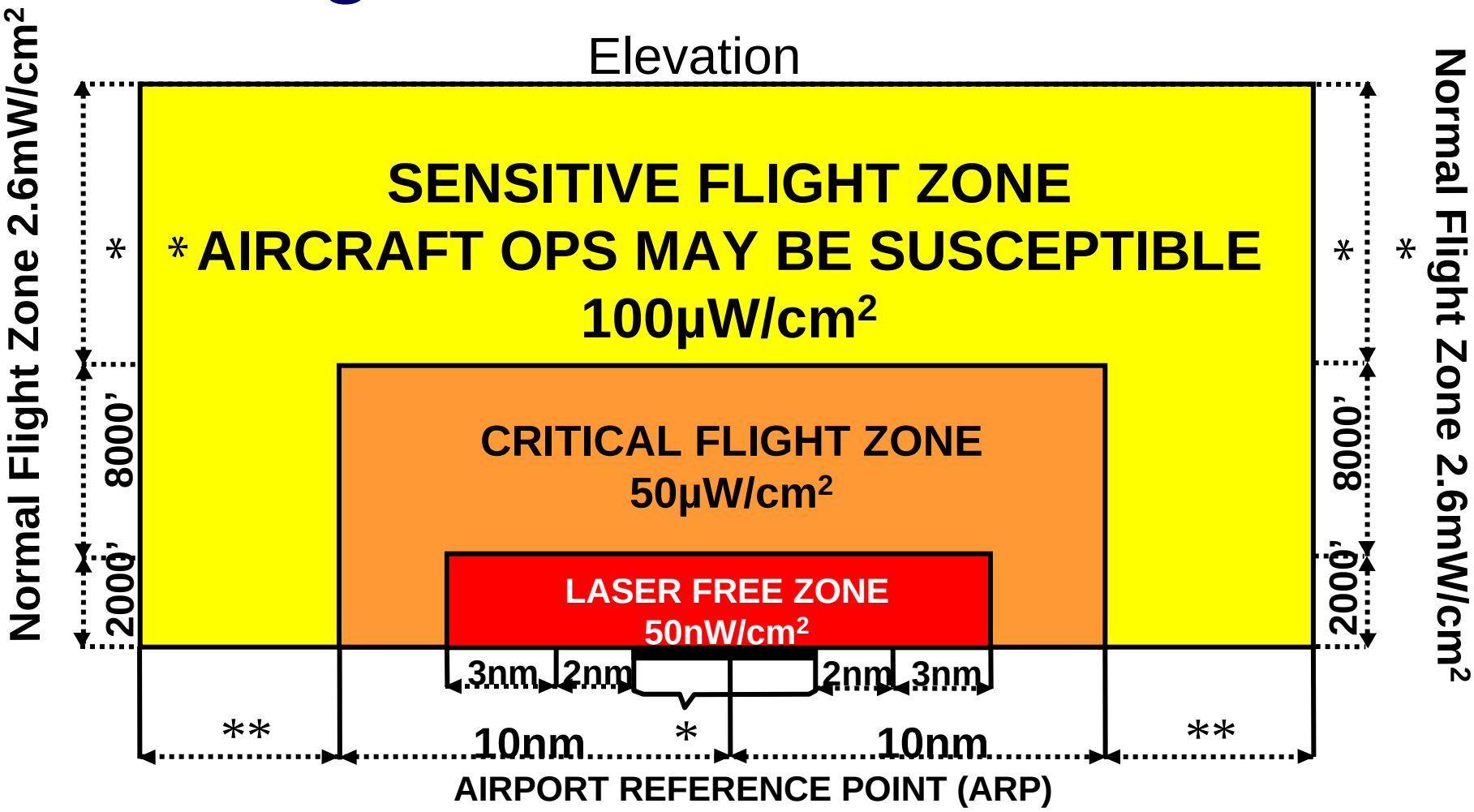
Normal Flight Zone



All 4 Flight Zones, Plan View



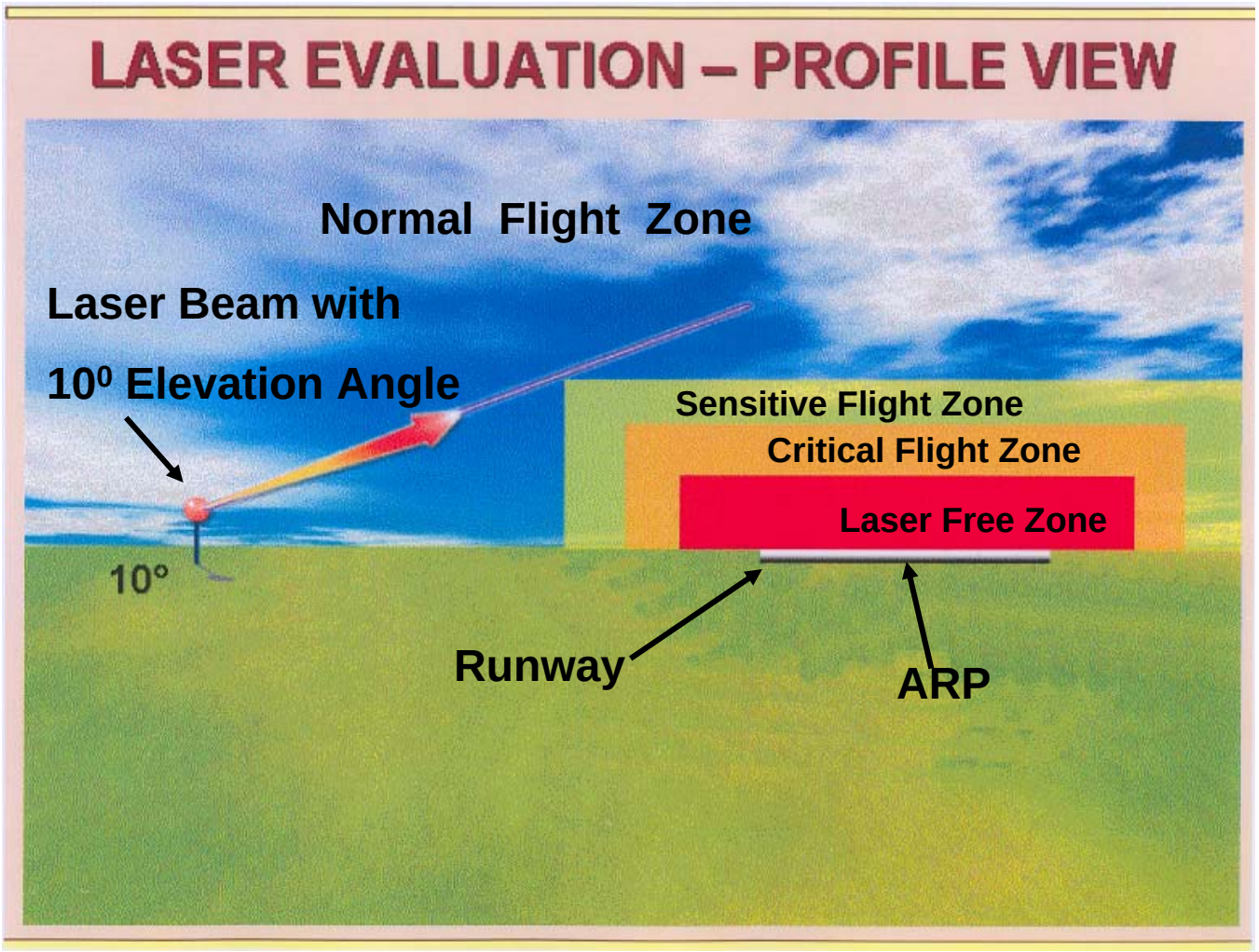
All 4 Flight Zones, Profile View



** Runway length varies per airport. AGL is based on published airport elevation.*

*** To be determined by local FAA evaluation and/or local airport operations.*

Flight Zone Evaluation



Demonstration of FAA Web-Based Laser Evaluation System